

CENDI: A STRATEGIC ALLIANCE IN STI

**Scientific and
Technical
Information (STI)
as an integral part
of the R&D & Tech
Transfer process:

An STI manager's
perspective**

*Commerce
Energy
NASA
NLM
Defense
Information
(CENDI)*

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CENDI: A STRATEGIC ALLIANCE IN STI

Today I'm going to present the perspective on STI from the viewpoint of those who aid in the transfer of STI but are not generally creators of STI. STI - or knowledge - transfer agents add value to STI by collecting, categorizing and indexing it, and providing dissemination alternatives.

TOPICS

- STI its Role & Value
- STI Model
- CENDI Background & Purpose
- Issues & Challenges
- Closing Comments

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Here's what I'm going to talk about starting with some discussion of the raison d'être of STI, then discussing STI transfer, what CENDI is doing to help improve R&D productivity, and then offering some issues which are critical to further exploitation of STI, a major element of our technology base.

FEDERAL STI PROGRAMS

RECOGNIZE:

- Science is "shared knowledge of cumulative efforts"
- R&D resources are scarce
- R&D infrastructure (Govt. and Private) is dispersed geographically as well as by discipline
- Need for consistent support of Federally sponsored endeavors

SEEK TO:

- Reduce unnecessary RDT&E expenditures
- Leverage existing knowledge base of science and technology & promote technology transfer
- Achieve economies of scale via networks & central services

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Federal Scientific and Technical Information (STI) activities exist to serve the science, engineering, test, and evaluation communities helping to reduce cost, leverage the existing technology base, and provided enrichment to the flow of STI through services normally not obtainable by local organizations.

When we focus on productivity improvement we can't forget the need for increased R&D productivity, both in the public and private sectors where billions are invested to use the knowledge created by scientists and engineers....STI and access to it are critical to every R&D project.

STI IS KNOWLEDGE TRANSFER

- **New products and services within the domain of sponsorship or interest**
 - Biomedical research resulting in new vaccines
- **New products and services beyond the domain of sponsorship or interest**
 - Image processing techniques developed for NASA, USGS, NOAA paved the way for development of CAT scans and MRI used in Medicine
- **Product and service improvements to better implement legislative, judicial, and policy mandates**
 - Science and technology has been enlisted to aid in all facets in the battle against illegal drugs

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The use of science and technology within the domain of the sponsoring Federal agencies and departments has been the hallmark of Federal science and technology policy during the post-Sputnik era. Government contracts and grants have given rise to new products by academia and/or the private sector of specific interest to DoD, DoE, and NASA. Contractors successfully developed solid state devices, massive computers, and a broad range of products and services initially in response to a Federal government requirement which in turn created a market of sufficient size such that an entire civil industry could be sustained.

DoD sponsorship of gas turbine propulsion led to the development of alternative propulsion systems used in commercial vehicles on land, at sea, and in the air.

Over the past 40 years, NIH, CDC, and DoD have sponsored substantial biomedical research resulting in new vaccines. Distribution and use of these vaccines has enabled public health officials to take aggressive measures in advance of serious outbreaks of disease, thereby reducing the number of seriously affected victims, the economic losses due to lost productivity, and the continued spread of diseases such as Asian flu, hepatitis, typhoid, rubella, mumps, measles, polio, tuberculosis, as well as more exotic diseases not identified as endemic to most of North America.

Of equal note and of great potential is the impact of government sponsorship of science and technology which impacts outside the domain of the sponsor. Materials developed by the Army's Night Vision Laboratory at Fort Belvoir to aid in image intensification found widespread application as filters for use in kidney dialysis processes. Image processing techniques developed for NASA, the U.S. Geological Survey, the National Oceanographic and Atmospheric Administration paved the way for development of CAT scans and magnetic resonance imaging used in medicine and in nondestructive evaluation/nondestructive inspection in materials processing, construction, and other manufacturing processes. 205

OPERATIONAL SAVINGS FROM STI

- \$ saved when earlier, relevant work can be summarized, data extracted, and only limited additional laboratory/field work is needed.
- \$ saved because scarce resources are utilized in a more effective and efficient manner.
- Time saved between the statement of a problem and its solution because efforts are devoted to filling gaps in human knowledge and understanding, not duplicating the entire past and then arriving at solutions.
- The net dollar benefit to DoE of its annual expenditure on STI was on order of billions to tens of billions of dollars.
- The benefit-cost ratio for the DoD IAC Program as a whole was conservatively estimated to be about 4 to 1.

CENDL: A STRATEGIC ALLIANCE IN STI

STI can result in quantifiable savings because:

- Fewer dollars may be needed to achieve a desired outcome because earlier, relevant work can be summarized, data extracted, and only limited additional laboratory/field work is required.
- Fewer dollars may be needed because scarce resources are utilized in a more effective and efficient manner.
- Fewer units of time may elapse between the statement of a problem and its solution because efforts are devoted to filling gaps in human knowledge and understanding, not duplicating the entire past and then arriving at solutions.

Cost savings are not present in all cases in which STI plays a major role in an R&D program; but in many cases, studies conclude that information analysis --the collection, extraction, synthesis, and dissemination of scientific and technical information -- save considerable dollars.

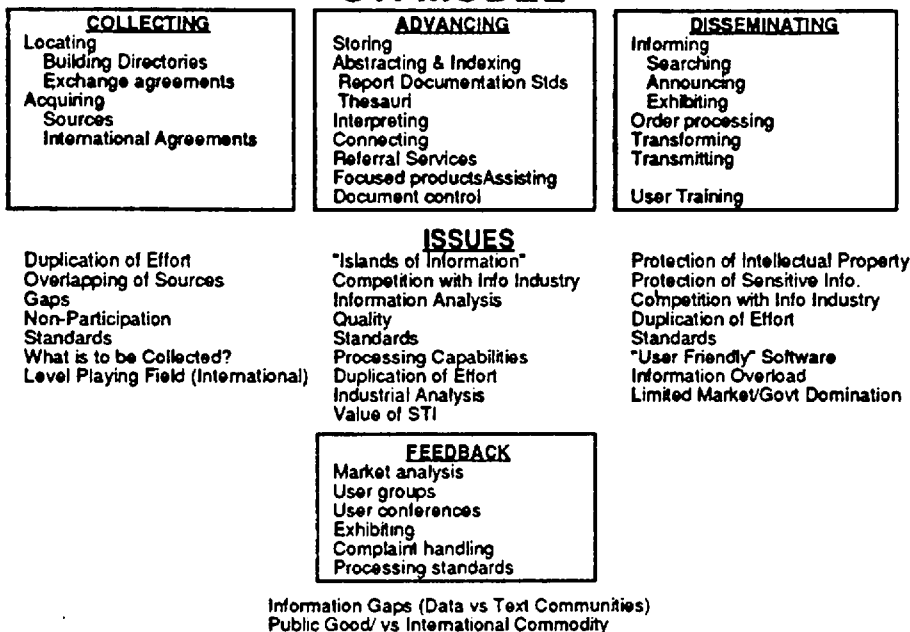
DoE Studies concluded that the net dollar benefit to DoE of its annual expenditure on STI was on order of billions to tens of billions of dollars. A more recent study of the DoD Information Analysis Centers Program concluded that where both information cost data and verifiable information benefit data could be examined, the benefit-cost ratio for the DoD IAC Program as a whole was conservatively estimated to be about 4 to 1.

There are also other benefits resulting from the use of STI.

- STI saves lives and changes the manner by which an organization operates.
- Use of STI results in product and/or process improvements.
- Sustaining and increasing the confidence of users in products and/or services consumed.

STI does not in and of itself save money, save time, change operations resulting in an increase in the economy, efficiency, or effectiveness of a governmental activity, a good STI program can provide these benefits. **206**

STI MODEL



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The purpose of this model is to put some boundaries on what is meant by STI and its management. The model includes:

the collection of STI- either physically or through electronic connection to other sources,

the enrichment of STI to aid in STI access, retrieval, & use as well as obtaining economies of scale, where possible,

the announcing of the availability of and transfer of STI to users, and

the evaluation of service and customer needs

Examining some of the issues several things become apparent.

Overlap and unnecessary duplication is probable when STI management is left entirely within the domains of the individual agencies.

Use of local vocabularies and thesauri and lack of standards, for example can lead to "islands of information".

The role of government activities, both in regards to competing with industry and in assisting industrial efforts is unclear and inconsistent.

The analysis of information content and transformation of information into the form required by an individual user are roles that must be played by both STI managers and researchers in close cooperation.

DYNAMICS OF CHANGE

- Volume of Data Collection
- Expanding Range of Media & Transmission Alternatives
- Tendency to Cross Traditional Disciplinary Boundaries
- Growth of International Sharing
- R&D as an Economic Weapon/ Science as a Business



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There is a growing increase in attention to STI - both because of a growing need for better information and because of several general trends, trends which began over two decades ago

The most significant is the impact of information technology on information users which provides capacity previously not adequate to meet the latent demand. The expanding range of media and transmission alternatives, along with the continual increase in computing capacity and software building knowledge, are now removing barriers to the creativeness of researchers. Electronic mail expands the collegial campus and electronic publishing improves the information transfer capability of documents.

Computerized instruments gather data many orders of magnitude greater than previous methods. Telecommunication capabilities can link researchers to computing facilities with vast capabilities and with data sources not constrained by geographical location. Data are available, not only in computerized databases, but also from sensing and other data gathering instruments. New analytical approaches are possible through graphics, color enhancement, animation, and other visualization techniques. **With this ever growing capability there is a need to help teach researchers to better use it, to develop better ways to store, retrieve data and to maintain its integrity, and to determine how to assure intellectual property rights in an electronic network.**

Another trend is the increasing interdisciplinary nature of research. The recognition of the need to cross over into other disciplines makes it clear that many of today's significant research challenges are interdisciplinary in nature. What is important is the challenge to overcome the barriers of terminology and differing methodologies and to design systems to accommodate the needs of researchers who must go outside their principal discipline.

Science is increasingly becoming internationalized. Aided by communications networks which facilitate raw data exchange and access to databases, as well as personal conversation via electronic mail, many major research efforts now involve worldwide data collection and scientific collaboration. **Tempering the desire to advance science through international collaboration is the growing need of government and industry leaders to advance national or regional interests while restricting competing nations' or regions' advancements.**

In today's technology-driven world, the financial or other rewards from scientific and technological advancements are staggering. This contributes to the discussion of how to balance desire for unrestricted flow of STI with the economic and national security concerns of nations.

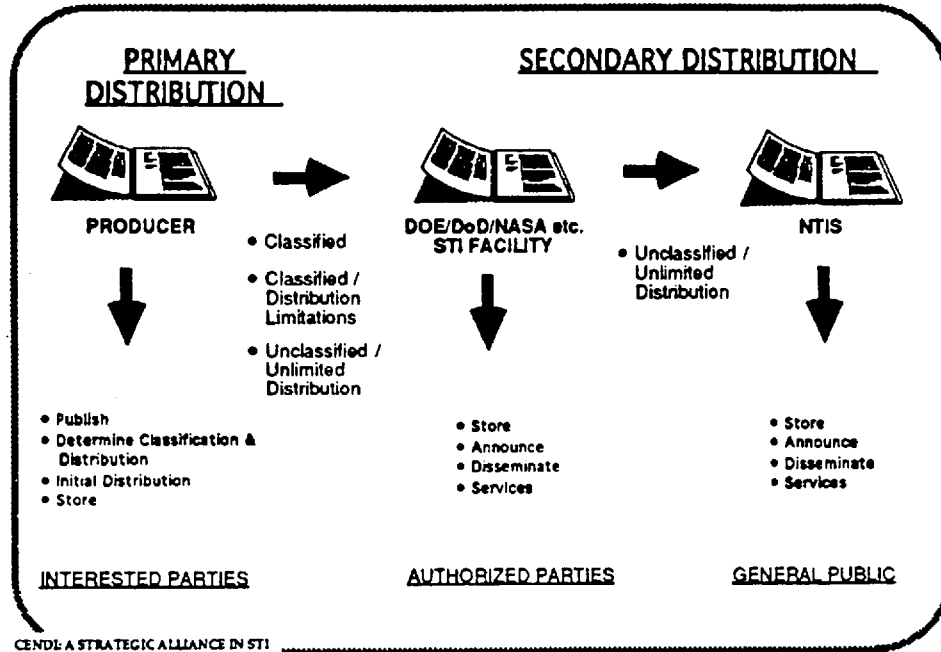
HISTORY of CENDI

- 1973 Phase out of COSATI
- Mid 1970s - Mid 1980s Cooperation on ad hoc basis
- 1982 Regular but informal meetings
- 1985 Formal interagency MOU among 4 agencies
- 1987 NLM joined through MOU Amendment
- 1988 Secretariat created

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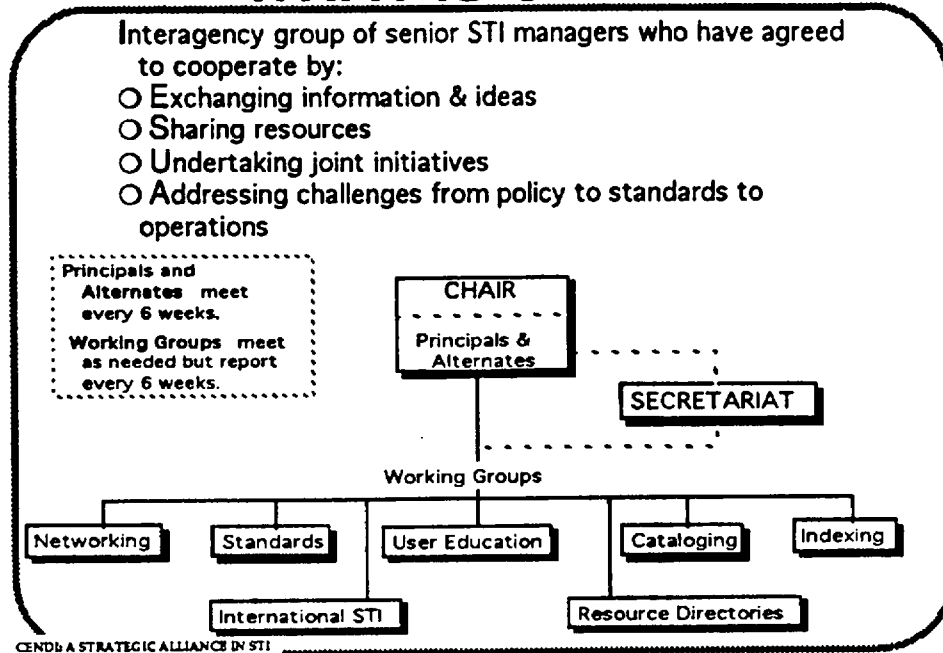
When the Committee on Scientific and Technical Information (COSATI) a part of what is now the Federal Coordinating Council on Science, Engineering and Technology (FCCSET) was phased out a void was left. Feeling a need to address some common operational problems the Senior managers of the largest federal STI centers formed a group known as CENDI - the Commerce, Energy, NASA, NLM, Defense Information Group. It was initially done in an ad hoc manner by the managers who later created the formal interagency MOU which legitimized CENDI. In 1988, we began contributing \$25000/year to pay for the administrative, as well as some contractor work, to support CENDI efforts.

TECHNICAL REPORT FLOW



To understand one of the reasons why CENDI was formed it's necessary to understand the relationship of NTIS to the the agencies with a large R&D mission. Each - DOE, NASA, and DoD - have STI centers to handle technical reports. Those reports that have been cleared for distribution to the general public are provided to the NTIS. In this way the DoE, NASA, and DoD are isolated from the demands of the general public and thus, better serve their Departmental R&D mission. Together, these three activities provide the majority of the domestic input to NTIS. NLM handles no technical reports.

WHAT IS CENDI?



CENDI addresses common challenges and undertakes joint projects designed to enhance the flow of STI. These are not all permanent working groups. We organize our work efforts to meet needs not to create them. We also have an annual planning session and develop an annual plan assigning priorities to our work efforts.

EXAMPLES OF TOPICS COVERED BY CENDI

- Information technology and the conduct of research
- Global change data & information management
- HPC/NREN - Communications issues
- NSF assessment of STI dissemination in the United States
- STI & national competitiveness
- Information policy issues
- Intellectual property rights
- Numerics, directories, and networking
- Integrated information systems
- Education & training for Information System professionals
- TQM

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This is a sample of the subjects discussed in our regular meetings. You can see it's a wide range of subjects.

MEMBERSHIP

PRINCIPALS

- Don Johnson, Acting Director, National Technical Information Service (NTIS), DoC
- Elizabeth Buffum, Manager, Office of Scientific and Technical Information (OSTI), DoE
- Gladys Cotter, Chief STI Division, NASA
- Kent Smith, Deputy Director, National Library of Medicine (NLM), DoHHS
- Kurt Molholm, Administrator, Defense Technical Information Service (DTIC), DoD

ALTERNATES

- Tom Walker, NTIS
- Mark Fornwall, OSTI
- John Wilson, NASA
- Elliot Siegal, NLM
- Marsha Hanna, DTIC

SECRETARIAT

- Bonnie Carroll, Information International

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This is the current membership of CENDI. However, CENDI invites a wide range of observers to our meetings - people from OMB, NOAA, USGS, EPA, etc., from the "Hill", and occasionally from academia, industry, etc.

STI ISSUES & CHALLENGES

- **Legislative and National Policy Issues**
 - Protection of intellectual property
 - Information security and privacy
 - Right to access versus right to use
 - Cost of access versus cost of use
- **Working Level Issues**
 - Formats
 - Transfer protocols
 - Specific content of STI

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With the growing recognition of the value of STI several issues requiring national policy guidance arise.

First, to the extent that STI facilitates the translation of basic science and technology into tangible products or commercial services, who owns STI? To whom should fair and just compensation be offered whenever STI is acquired? What about its use? The entire global intellectual property community is struggling with this issue, and it is unlikely that agreement at the international and/or national level will be reached soon.

Second, there is a serious concern about providing various types of STI to certain classes of prospective users. STI developed as part of efforts by various national security related agencies and departments clearly falls into a category of information not necessarily accessible to any and all potential consumers. But there are other organizations within the U.S. Government developing STI for which its use or abuse might have dire consequences. Consider the impact on agricultural markets in the event that STI setting forth estimates of crop yields post Hurricane Andrew were to make its way into the hands of the investment community without prior review and massaging by the cognizant U.S. Government agencies.

Third who should be afforded use of STI produced under U.S. Government auspices, sponsorship, control, or direct participation? Should all users have the same ability to use the same U.S. Government STI, or should the U.S. Government discriminate in access based on some set of criteria designed to protect "national interest"? Does access – the right to view STI– translate immediately into the right to "use" STI?

Fourth, even though some STI consumers have either the right or privilege of access in some de jure manner, the de facto costs of obtaining access may sometimes preclude effective use of STI. If, for example, moving to a fee for service environment the cost of obtaining STI may lead to potential users curtailing or terminating STI services. These customers no longer utilize STI effectively and thereby increase the effective cost of their products and services. Is it good policy to increase the cost of obtaining government STI and risk unnecessary duplication of effort or work?

These are broad national policy issues on which direct guidance from the Congress and the most senior levels of executive branch management are probably necessary before final policies are adopted.

On the other hand, there are a series of nitty-gritty problems affecting the working level use of STI which may rarely if ever rise into the field of view of senior R&D management. For example, questions of STI format, communication protocols, the specifics of "STI" as defined within a mission area, a function, or a discipline need not enter into the interagency arena on a recurring basis. The exception may be where agencies are unable to find agreement such that common work is interrupted in some manner.

ISSUES OF CONCERN

✓ SENIOR R&D/INFORMATION MANAGEMENT

- National Leadership to Address - and Solve - the Complex Problems of Maintaining Intellectual Property Rights, Data Integrity, and Critical or Sensitive information in a World-Wide Electronic, Virtual Database

✓ SCIENTISTS/ENGINEERS

- Policy on Preservation and Access to Older Information

✓ INTERFACING

- Development of Tools for Easier Identification and Access and Better Software Tools to Use Once STI is Obtained
- Definitions of Data & Information in today's digital world can create barriers or help promote understanding & cooperation.

✓ OPERATIONAL

- Standardization for Better STI Transfer and Sharing
- Quality of Service

A National Commitment Promoting a Quality Infrastructure to:

- Ensure Equity of Access to
- Quality/Integrity of
- Protection of Intellectual Property Rights in the **Knowledge Base**

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CONCLUSION

When viewed in a total competitive context, Scientific and Technical Information is the backbone of our competitive edge...The Federal Government has a golden opportunity to help the United States sustain a competitive position...(but) executive branch leadership is imperative because scientific and technical information is generated by many Federal R&D agencies that must be coordinated..."

... Office of Technology Assessment

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Effective STI is needed in industry

- Effective access to information prevents overdesign, reduced waste in construction and increases product longevity.
 - 5% of the \$135 Billion U.S. chemical industry costs could be saved if data needs were brought to level of completeness with other design tools (DWH Roth, Allied Chemical)
- \$119 Billion spent in anticipation or as a result of fracture in U.S. in 1982
 - 4% of GNP
 - \$35 Billion could have been saved by use of best practice and technology
- \$70 Billion was spent on corrosion in 1975
 - 4.2% of GNP
 - 15% avoidable through knowledge available

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